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Comparative study of calcium gluconate therapy and platelets rich plasma in hair rejuvenation treatment

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Abstract

Background:
Hair loss is a frequent problem that impacts physical appearance and psychological health. Platelet-Rich Plasma is best treatment and calcium gluconate activation could further augment the regeneration ability and enhance hair rejuvenation results.

Objective: To compare the efficacy of PRP alone versus calcium gluconate therapy combined with platelet-rich plasma in promoting hair rejuvenation in patients with hair loss.

Methods: A Comparative study with cross sectional design was conducted of total 92 patients with hair loss in which they were divided into two groups of PRP alone (n=46) and Calcium Gluconate + PRP (n= 46). The structured questionnaire was used to obtain the data which were analyzed by SPSS version 26.0.

Results: There were significantly more improvements in hair density, hair thickness, hair quality, new hair growth and reduction of hair shedding in the Calcium Gluconate + PRP group compared to the PRP group. Also an improvement in treatment satisfaction and willingness to recommend treatment in the combination therapy group ($p < 0.05$).

Conclusion: PRP (with calcium Gluconate) proved to be more effective than PRP alone to promote rejuvenation of the hair. The hair loss management using combination therapy is a safe and a promising approach.

Introduction

PRP is a novel method that can be considered for the regeneration of different types of alopecia, including AGA and AA. PRP is an autologous product created from patients blood samples through centrifugation, to collect platelets. Platelets are rich sources of various growth factors and cytokines and release them in their turn, which play a role in the regeneration and repair process (1).

Complex biological processes play a role in the regulation of hair follicle growth dynamics, in addition, there is considerable inter-individual variation in the time required for hair growth, both in normal and alopecic conditions. Their study showed that the behavior of their follicles is very sensitive to variations in the most important regulating factors, which is a problem for prediction of treatment outcomes. Findings are important for development of effective regenerative therapies for promoting the activity of follicles and improving hair growth. Thus, new therapies like Calcium Gluconate and Platelet-Rich Plasma (PRP) should be explored for their possible applications in hair rejuvenation (2).

The positive effect of A-PRP on the hair growth can be understood from the biological point of view, as its action on DPCs, which play a direct role in the regulation of the hair growth cycle, is the explanation. In this way, activation of MAPK, Akt pathways triggers the growth and survival of DPCs and concurrently blocks the apoptosis and inflammation (3).

Alopecia (AGA) also known as male and female pattern hair loss, is a progressive disease that is characterized by the gradual miniaturization of the hair follicles and hair thinning. It is a condition which many people worldwide suffer from and which can have a profound psychological and social impact on patients. While traditional methods for hair restoration, such as minoxidil and finasteride drugs, are in use, the defects and unpredictable results of these methods were a motivating factor for the development of more effective approaches to hair regeneration (4).

The diagnosis and treatment of Androgenetic Alopecia is possible clinically and by using minoxidil. Typical distribution of hair loss is used to diagnose alopecia areata and the condition is self-limited. Tinea capitis is a condition that results in patches of alopecia, which may be erythematous and scaly and requires systemic treatment. Telogen effluvium is alopecia that occurs without scarring or inflammation and is of sudden onset due to physiologic or emotional stresses. Once the precipitating cause is removed, the hair typically will regrow (5).

PRP therapy is a growing trend in aesthetic medicine for its regenerative effects. PRP is made from a person's blood and has a high platelet concentration that, when injected into damaged tissues, can aid in repair and regeneration. The use of PRP in dermatology is growing in popularity for hair restoration due to the stimulatory effects it has on the endogenous growth factors (6).

Alopecia androgenetic is a type of hair loss seen in men and women, characterized by a specific pattern of hair loss. It seems that genetic susceptibility and adequate circulating androgen levels play an important part in the development of this disorder, and while androgenic alopecia is a common condition in Caucasian men (up to 50% by the age of 50) it does not have any serious consequences apart from affecting the appearance of the individual (7).

In recent years, there have been many advances in the study of the mechanism behind the development of androgenic alopecia. The hair follicles of the scalp that are predisposed to balding undergo a series of events, from extended periods of hair growth to longer rest periods followed by shorter periods of growth, and a subsequent reduction in the size of the follicles themselves. Both the process of development and miniaturization are dependent on androgens and involve several genes. As yet only one gene has been identified, the androgen receptor (AR), but these treatments are not effective in everyone (8).

The aim of this study is to regenerate hair follicles by stimulating them with growth factors as a therapy for androgenetic alopecia. The method of platelet activation effects the treatment efficacy. Traditional activators have immediate but short-term results. It is proposed that calcium gluconate would release more slowly and be more biocompatible.

Thus, the present study compares the results of hair restoration for calcium gluconate therapy versus PRP.

LITERATURE REVIEW

Rania Mahmoud et al. (2021) studied the efficacy of single-spin versus double-spin platelet-rich plasma (PRP), in the treatment of female pattern hair loss (FPHL). The total number of female patients that were included and received double-spin PRP injection on the right side of the scalp was 15, and single-spin PRP injection was done 3 weeks apart on the left side of the scalp. The outcomes after six weeks found that both sides improved clinically after the use of the final session, but there was significantly higher terminal hair density in the double-spin method than in the single-spin method, which proved to be more effective. Furthermore, there were no significant differences in vascular endothelial growth factor (VEGF) levels between the two preparation techniques or after calcium gluconate activation, indicating that there was no improvement in treatment outcomes from activation with calcium gluconate. Based on the results of this study, it is concluded that PRP is an effective treatment for FPHL as the double-spin preparation technique shows better clinical results than the single-spin technique and calcium activation does not add any benefit (17).

Smith et al. (2023) examined the current evidence regarding the use of platelet-rich plasma (PRP) in hair restoration and skin rejuvenation, analyzing studies published up to October 2023 with emphasis on recent literature from 2020 onward. The results suggest that PRP and its related therapies have promising potential benefits, especially in areas like androgenetic alopecia and skin rejuvenation, where there is more clinical evidence. But the results also reveal that there are many drawbacks, such as the variability in the composition of PRP, preparation methods, dose, frequency of treatment, etc., which result in the absence of standardized protocols by the clinicians. Based on this review, PRP is an effective and promising therapy in dermatology, but additional well-designed randomized controlled trials with uniform outcomes should be performed to establish guidelines, reach consensus and improve its clinical use in the future (18).

Arianne Shadi Kourosh et al. (2024) analyzed recent evidence on platelet-rich plasma (PRP) in hair restoration, the authors noted that there are multiple studies that support the effectiveness of PRP, especially in hair restoration and skin rejuvenation, but the lack of uniformity in the preparation of PRP, dosage, and protocol requires further randomized controlled trials to establish uniform guidelines. Likewise, Ebtisam et al. (2018) in his comprehensive review found that PRP has many clinical uses in dermatology and aesthetics, such as wound healing, induction of hair growth, improvement of hair density and quality, and skin rejuvenation, but also highlighted the need for standardization of techniques and insufficient procedural consistency. In general, both studies have shown that PRP can be a useful and effective therapeutic option for hair and skin care, but with further investigation to find standardized protocols and optimizing clinical outcomes (19).

Suat Morkuzu et al. (2023) evaluated the clinical efficacy and safety of activated platelet-rich plasma (A-PRP) in the treatment of alopecia by analyzing 29 studies involving 864 patients. The study results revealed that A-PRP was significantly effective for pre and post treatment, and compared to control groups in improving hair density; there were significant increases in terminal hair density and hair counts before and after treatment, as well as promotion of hair regrowth, the formation of new hairs, and decrease of hair loss. The results were consistent across the literature, with the majority of the studies included (27 of 29) reporting positive impacts. Twenty-seven of

the 29 studies included reported positive impacts, while only two reported no significant impacts. A-PRP was found to be a promising and safe therapeutic option in the management of alopecia; however, some variations and heterogeneities among studies are noted, suggesting the necessity of additional research with standardization of protocols and long-term outcomes (20).

Kamal Hospital Research Group et al., 2018, the authors investigated the effect of the three different types of anticoagulants (ethylenediaminetetraacetic acid (EDTA), sodium citrate and acid citrate dextrose-A (ACD-A) on the platelet quality and quantity in platelet rich plasma (PRP) to be used for hair rejuvenation in 50 patients with diffuse hair thinning (Norwood Grades II–III). The quantitative analysis, automated platelet count and manual platelet count revealed that the platelets in the PRP prepared using ACD-A were the highest with around 310% more platelets as compared to baseline, which was statistically significant. The platelet morphology of PRP collected from ACD-A was also better, where the platelet aggregation was extremely low and there was no cellular debris in the blood smear which is statistically significant. But, EDTA and sodium citrate samples demonstrated loss of integrity of platelets and alteration of their morphology. The patients receiving treatment in the clinic prepared PRP in ACD-A vials were found to have improved results after 6 sessions of treatment and follow up. ACD-A was found to be the most suitable anticoagulant for PRP preparation as it provides optimum yield and quality of platelets which leads to optimum therapeutic efficacy in hair rejuvenation process (21).

Sadick et al. (2020) used low-level laser therapy (LLL-T), micro-needling technique (MN-T) and autologous non-activated platelet-rich plasma (ANA-PRP) to assess their effects in patients with androgenetic alopecia. Twenty-three patients (13 males in Norwood–Hamilton stages I-V, 10 females in Ludwig stages I-III) were studied with standardized phototrichograms, clinical photography and physician/patient global assessment for up to 58 weeks. The authors noted that the synergic effect was shown to be more effective than PRP alone in terms of increased density and number of hairs, but also highlighted that PRP is not currently standardized for use, with different formulations employed, and that a particular type of PRP formulation may be beneficial to maximize the therapeutic effect, depending on the molecular properties of the formulation (22).

MATERIAL AND METHODS

Study design:

Our research design was the cross sectional.

Setting:

Research conducted in the Bloom Beauty Aesthetic Clinic.

Research duration:

The research duration was 4 months after the approval of synopsis.

Sample Size:

Sample size calculation by using this formula:

Sample Size

Total sample size was 92 participants in this study.

Sampling Technique:

The non probability convenience sampling technique was used.

Sample Selection:

Inclusion Criteria

- Patients aged 18–50 years.
- Has been diagnosed by a physician with androgenetic alopecia.
- Desire to be treated and followed-up.
- Given written informed consent.

Exclusion Criteria

- An active scalp infection or inflammatory scalp disease.
- History of bleeding disorders or anticoagulant therapy.

- Pregnancy or lactation.
- Hair surgery done in the past 6 months.

Data collection procedure

The participants who fulfilled inclusion criteria were recruited written informed consent obtained before enrollment in respective treatment groups. Demographic and clinical information was collected at baseline prior to treatment, as per study protocol. Follow up assessments were carried out following treatment sessions and all assessments were recorded on a data collection form for statistical analysis.

Data analysis procedure

Data were collected and analyzed by using SPSS version 27. Demographic and clinical variables were used in descriptive statistics (percentages, means and standard deviations). Appropriate statistical tests were used to compare treatment outcomes between the both groups and p value below than 0.05 considered as the statistically significant.

RESULTS

Descriptive statistics of age and duration of hair loss

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Age	92	21	49	36.48	8.534
Duration hair loss years	92	.5	5.0	2.665	1.3435
Valid N (listwise)	92				

Interpretation:

Total 92 participants were part of the study. The average duration of hairs loss of participants was 2.67 ± 1.34 years and the average age was 36.48 ± 8.53 years. The conclusion drawn from these findings was that the participants were mostly middle aged adults with moderate duration of hair loss.

Association between treatment group and family history of hair loss

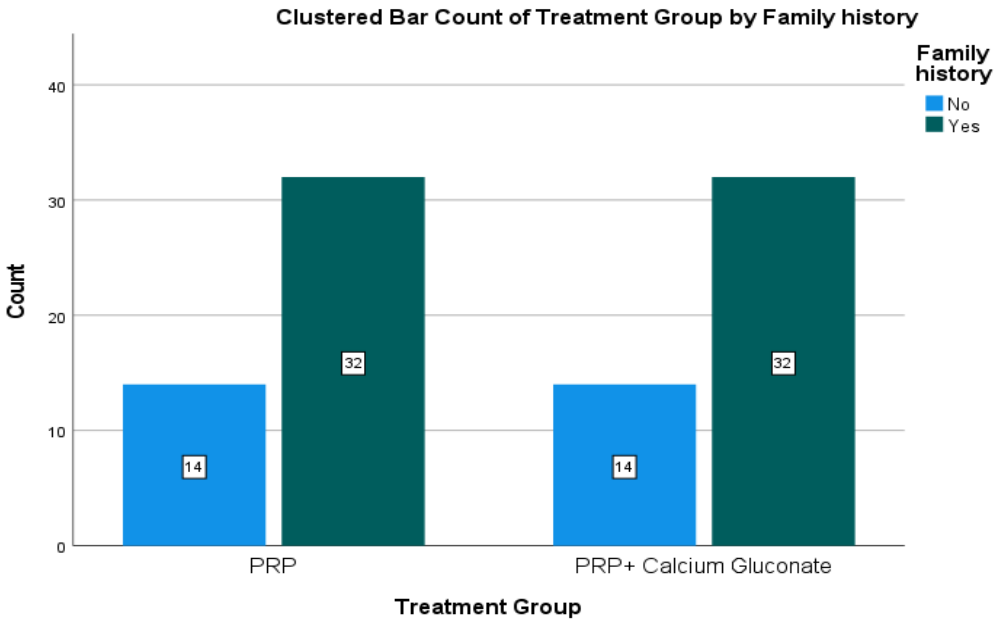
Crosstab					
			Family history		Total
			No	Yes	
Treatment Group	PRP	Count	14	32	46
		% within Treatment Group	30.4%	69.6%	100.0%
	PRP+ Calcium Gluconate	Count	14	32	46
		% within Treatment Group	30.4%	69.6%	100.0%
Total		Count	28	64	92
		% within Treatment Group	30.4%	69.6%	100.0%

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.000[a]	1	1.000		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.000	1	1.000		
Fisher's Exact Test				1.000	.589
Linear-by-Linear Association	.000	1	1.000		
N of Valid Cases	92				

Interpretation:

Total 69.6% of participants in both groups had a family history of hair loss. There was no statistical significant difference between both treatment groups (p = 1.000). This means that there was an even distribution between participants of hereditary factors.

Family history of hair loss among participants



Association between treatment group and improvement in hair appearance

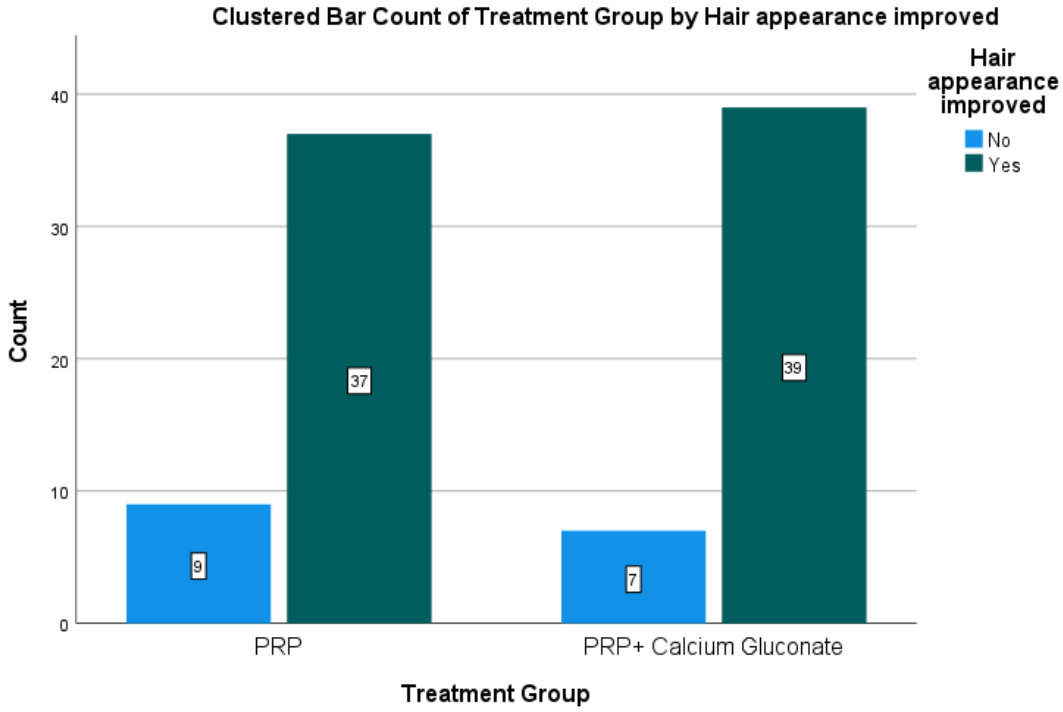
Crosstab					
			Hair appearance improved		Total
			No	Yes	
Treatment Group	PRP	Count	9	37	46
		% within Treatment Group	19.6%	80.4%	100.0 %
	PRP+ Calcium Gluconate	Count	7	39	46
		% within Treatment Group	15.2%	84.8%	100.0 %
Total		Count	16	76	92
		% within Treatment Group	17.4%	82.6%	100.0 %

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.303[a]	1	.582		
Continuity Correction[b]	.076	1	.783		
Likelihood Ratio	.303	1	.582		
Fisher's Exact Test				.784	.392
Linear-by-Linear Association	.299	1	.584		
N of Valid Cases	92				

Interpretation:

Total 80.4% of individuals in the PRP group and 84.8% of those in the PRP + Calcium Gluconate group reported an improvement in the appearance of their hair. Difference was the not statistically significant, however (p = 0.582). This means that both treatments were equally effective in improving the overall appearance of the hair.

Improvement in hair appearance



Association between treatment group and improvement in hair density

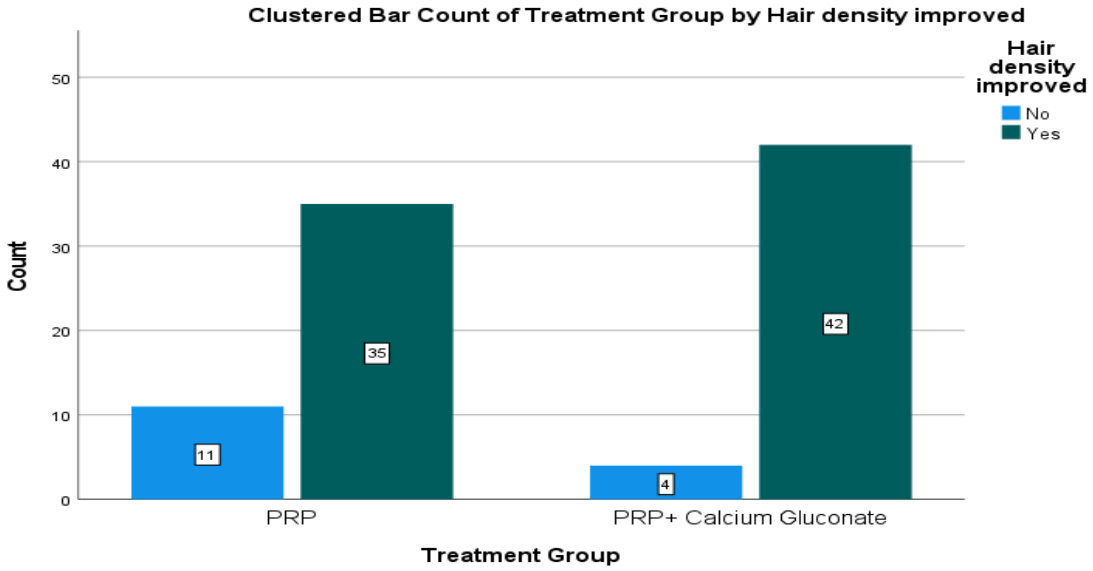
Crosstab					
			Hair density improved		Total
			No	Yes	
Treatment Group	PRP	Count	11	35	46
		% within Treatment Group	23.9%	76.1%	100.0 %
	PRP+ Calcium Gluconate	Count	4	42	46
		% within Treatment Group	8.7%	91.3%	100.0 %
Total		Count	15	77	92
		% within Treatment Group	16.3%	83.7%	100.0 %

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.903[a]	1	.048		
Continuity Correction[b]	2.868	1	.090		
Likelihood Ratio	4.034	1	.045		
Fisher's Exact Test				.088	.044
Linear-by-Linear Association	3.861	1	.049		
N of Valid Cases	92				

Interpretation:

Hair density was improved in 76.1% of the patients who received PRP and in 91.3% of patients who received PRP + Calcium Gluconate. This difference was significant statistically (p = 0.048). These results show that combination therapy provides better results for hair density improvement.

Improvement in hair density



Association between treatment group and recommendation of treatment

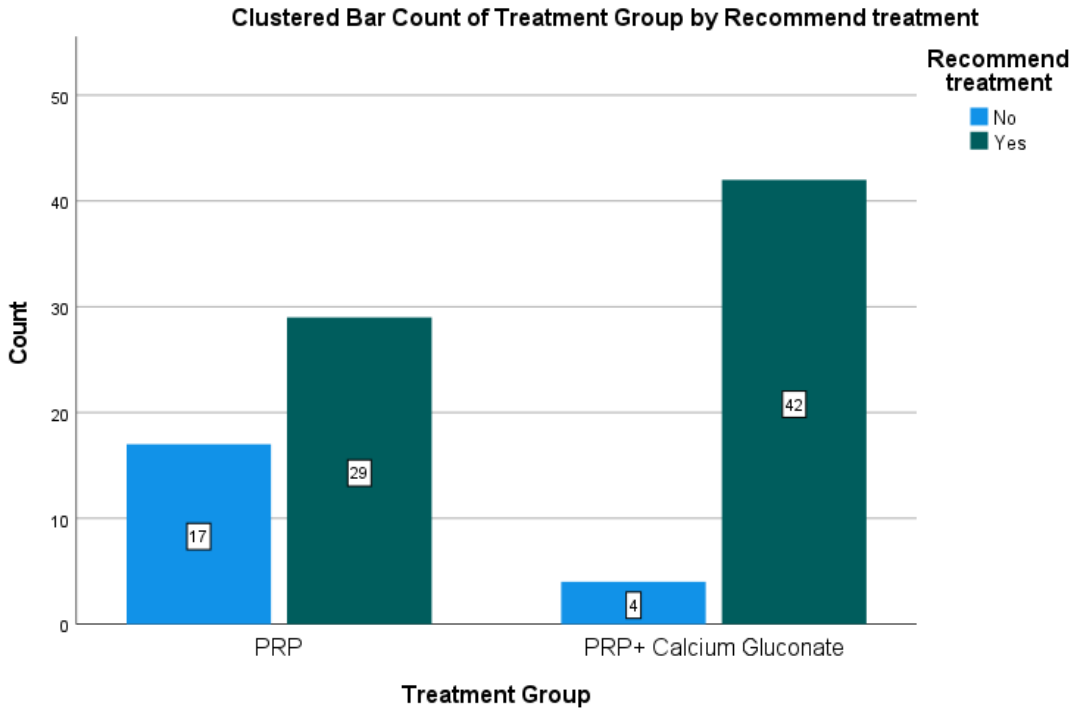
Crosstab					
			Recommend treatment		Total
			No	Yes	
Treatment Group	PRP	Count	17	29	46
		% within Treatment Group	37.0%	63.0%	100.0 %
	PRP+ Calcium Gluconate	Count	4	42	46
		% within Treatment Group	8.7%	91.3%	100.0 %
Total		Count	21	71	92
		% within Treatment Group	22.8%	77.2%	100.0 %

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	10.428[a]	1	.001		
Continuity Correction[b]	8.885	1	.003		
Likelihood Ratio	11.056	1	.001		
Fisher's Exact Test				.002	.001
Linear-by-Linear Association	10.315	1	.001		
N of Valid Cases	92				

Interpretation:

Total 63.0% of those taking the PRP group and 91.3% taking the PRP + Calcium Gluconate group said they would recommend the treatment to others. This association was significant (p = 0.001). Higher proportion of confidence in combination therapy.

Recommendation of treatment to others



DISCUSSION

Our study represents that the combination of the PRP and Calcium Gluconate resulted in significantly better outcome in terms of hair density, hair thickness and overall treatment satisfaction compared to PRP alone. The results suggest that growth factor enriched regenerative therapy may be a therapeutic option for hair rejuvenation. Abdin et al. (2022) assessed the efficacy of PRP in treating androgenetic alopecia and found that PRP acts on many dysregulated pathways associated with hair loss. PRP has been shown to induce angiogenesis, cell proliferation and regeneration of follicles, leading to better hair growth results due to the release of various growth factors, the authors concluded. The results of this study concur with the results of Abdin et al. (2022). When Calcium Gluconate was added to PRP it seemed to further boost its efficacy, resulting in better clinical outcomes and implying that there may be a synergistic relationship with hair follicle regeneration (3).

In our research, there was a significant increase in hair growth and hair quality in the participants who were given Calcium Gluconate activated PRP as compared to those administered PRP alone. These enhancements suggest greater stimulation of the hair follicles and increased regeneration. Miranda et al. (2025) studied the effects of prostaglandin F2α on human hair follicles and found that hair follicles were highly stimulated under ex vivo cultures. The authors also showed that these biological mediators are capable of effective promotion of follicular development and production of hair shafts, which can be used as part of the hair restoration therapy. The findings in this study can be compared to the findings of Miranda et al. (2025). The results of both studies suggest that increasing the biological stimulation of hair follicles can stimulate better hair growth, and, in clinical practice, Calcium Gluconate-activated PRP has demonstrated promising regenerative effects (4).

Our research showed that there was significant improvement in the hair density, hair thickness, hair quality and the patient satisfaction with Calcium Gluconate-Activated PRP when compared to PRP alone. The results indicate that better platelet activation results in better regenerative potential of PRP in hair rejuvenation therapy. Everts et al. (2024) evaluated the biological properties of protein-rich and platelet-rich plasma matrices in tissue repair and regeneration. The authors stated that PRP contains

abundant growth factors, cytokines, and bioactive proteins which stimulate cell growth, angiogenesis, tissue remodeling and wound healing. In their study, they emphasized the wide regeneration potential of this PRP in different clinical conditions. The results of the present study are in line with the observations made by Everts et al. (2024). This improvement in the findings of the Calcium Gluconate-activated PRP may be attributed to increased platelet activation and production of regeneration growth factors, leading to better stimulation of hair follicles and better hair growth (5).

The present study demonstrated that group 1, which was treated with Calcium Gluconate-activated PRP, experienced significantly more results in terms of hair density, hair thickness, new hair growth and overall treatment satisfaction compared to group 2, which was treated with PRP alone. Based on these results, it has been concluded that calcium gluconate can boost the regenerative power of PRP treatment. The effect of calcium gluconate on PRP activation and its effect on expression of VEGF-A in human dental pulp stem cells was explored by Margono et al. (2022). They concluded that calcium gluconate has the ability to increase the biological activity and regenerative nature of PRP. The higher rates of clinical results seen in the Calcium Gluconate + PRP group could be explained by increased platelet activation and increased growth factors including VEGF-A which may have led to the improved follicular regeneration and hair growth in the group compared to PRP alone (16).

CONCLUSION

Our research showed both Platelet-Rich Plasma (PRP) and Calcium Gluconate-activated PRP were found effective in rejuvenation of hair but with Calcium Gluconate-activated PRP showing better results. A statistically significant advantage was seen with PRP + Calcium Gluconate when compared to PRP alone for the following: Hair density, Hair thickness, Hair quality, New hair growth, Reduction in shedding. In addition, greater treatment satisfaction, willingness to recommend treatment, and likelihood of choosing the treatment again were observed in the combination therapy group. Side effects were reported in both groups, but the rates of side effects were low and not significantly different. In general, Calcium Gluconate-activated PRP was more effective and tolerable in its ability to rejuvenate hair than PRP alone.

RECOMMENDATIONS

1. Calcium Gluconate-activated PRP is a preferred treatment option for hair rejuvenation because of its superior clinical outcomes, and should be considered with patients who have a desire to improve their hair.
2. Dermatologists and aestheticians should consider using PRP activation techniques to maximize the effectiveness of their treatments.
3. Treatment outcomes should be followed up long term to assess treatment sustainability.
4. Further studies are needed to compare Calcium Gluconate-activated PRP and other new methods of regrowth in the treatment of hair loss.

LIMITATIONS

1. The study took place in one center, which may result in the results being not widely applicable.
2. The follow-up period was not extended; hence the treatment results achieved during this period may not be representative of long-term results.
3. Response bias can occur with PROMs.
4. Nutritional status, hormonal changes and lifestyle issues, which have role in the hair growth, have not been extensively investigated.

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